

**SUGGESTED RULE CHANGES FOR MERGING PART 21 AND PART 94 INTO PART 101**

**TELECOMMUNICATIONS INDUSTRY ASSOCIATION**  
Fixed Point-to-Point Communication Section,  
Network Equipment Division

**RECEIVED**

**MAY 23 1994**

April 6, 1994

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

The Commission is contemplating merging Part 21 and Part 94 of its rules into a new Part

101. In its ET Docket No. 92-9, the Commission initiated this consolidation by reallocating the bands above 3 GHz for co-primary use by common carrier and by private op-fixed microwave users.<sup>1</sup> This consolidation reflects the emerging convergence of private and common carrier microwave services and will facilitate future growth in these markets.

As the major industry association representing microwave manufacturers, the Fixed Point-to-Point Communication Section, Network Equipment Division of the Telecommunications Industry Association ("TIA"), is quite interested in how Parts 21 and 94 will be consolidated into new Part 101. Moreover, a TIA working group, TIA TR14.11, is completing its "Telecommunications Systems Bulletin No. 10-F, Interference Criteria for Microwave Systems" ("Bulletin 10-F"), which will prescribe standards for implementing the new channel plan adopted in the Second Report and Order and for establishing criteria regarding 2 GHz band PCS-to-microwave interference protection.

TIA fully supports the Commission's initiative in updating Parts 21 and 94 and consolidating them into Part 101. To assist the Commission in developing proposed rules for a new Part 101, attached hereto are TIA's initial recommendations. TIA will be discussing these proposals with the National Spectrum Managers Association ("NSMA"), which is a voluntary association involved in the frequency coordination of terrestrial microwave and satellite earth stations.

---

<sup>1</sup>Second Report and Order, ET Docket No. 92-9, 8 FCC Rcd 6495 (1993) ("Second Report and Order"), modified, Memorandum Opinion and Order (FCC 94-60, released March 31, 1994).

Should there be any questions concerning these proposals or any additional information required, kindly contact George Kizer, Chairman of the TIA Fixed Point-to-Point Communication Section (214-996-2822), or Robert J. Miller, Gardere & Wynne, L.L.P. (214-999-4219).

## SECTION 101.\_\_\_\_

### DEFINITIONS

#### PROPOSED RULE:

Section 101.\_\_\_\_ AUTOMATIC TRANSMIT POWER CONTROL ("ATPC").

ATPC is a feature of a digital microwave radio system that adjusts the transmitter output power. ATPC allows the transmitter to operate at less than maximum power for most of the time. Guidelines for use of ATPC are set forth in the TIA "Telecommunications Systems Bulletin No. 10, Interference Criteria for Microwave Systems," and are incorporated by reference herein.

#### REASON FOR RULE:

In the Second Report and Order (paras. 68-70), the Commission states that ATPC is permitted up to a 3dB increase in EIRP, thereby validating its use. Comsearch recommended that the rules be revised to include a definition of ATPC that allows for variable power operation below a transmitter's maximum authorized power and it recommended that implementing ATPC should be left to frequency coordinators. In this regard, the Commission decided to "encourage industry groups to explore in greater detail under what circumstances ATPC should be authorized and whether a greater increase in [EIRP] than 3 dB would be appropriate." Second Report and Order at para. 70. These guidelines are prescribed in TIA's Bulletin 10, Section 4.3. Consequently, herein TIA proposes that implementation of ATPC be consistent with the standards set forth in Bulletin 10.<sup>2</sup>

---

<sup>2</sup>Bulletin 10 periodically will be updated. Consequently, TIA recommends that the rules incorporate the generic Bulletin 10 instead of the current version, Bulletin 10-F.

## FREQUENCY COORDINATION PROCEDURES

### PROPOSED RULE:

#### SECTION 101. \_\_\_\_ (a) FREQUENCY COORDINATION.

When required by the rules governing a service subject to this Part, the following frequency usage coordination procedures shall apply.

- (1) **General Requirements.** Proposed frequency usage shall be prior coordinated with existing users in the area, other applicants with previously filed applications, and other users with previously coordinated proposals, whose facilities could affect or be affected by the new proposal in terms of frequency interference on active channels, applied-for channels, or channels coordinated for future growth. Coordination shall be completed prior to filing an application for regular authorization, an amendment to a pending application, or a modification to a license. In coordinating frequency usage with stations in the fixed satellite service, applicants shall also comply with the requirements of [§§21.706(c) and (d)]. In engineering a system or modification thereto, the applicant shall, by appropriate studies and analyses, select sites, transmitters, antennas and frequencies that will avoid interference in excess of permissible levels to other users. All applicants and licensees shall cooperate fully and make reasonable efforts to resolve technical problems and conflicts that may inhibit the most effective and efficient use of the radio spectrum; however, the party being coordinated with is not obligated to suggest changes or re-engineer a proposal in cases involving conflicts. Applicants should make every reasonable effort to avoid blocking the growth of systems as prior coordinated. The applicant shall identify in the application all entities with which the technical proposal was coordinated. In the

event that technical problems are not resolved, an explanation shall be submitted with the application. Where technical problems are resolved by an agreement or operating arrangement between the parties that would require special procedures be taken to reduce the likelihood of interference in excess of permissible levels (such as the use of artificial site shielding) or would result in a reduction of quality or capacity of either system, the details thereof may be contained in the application.

(2) Coordination procedure guidelines. The following guidelines are applicable to the coordination process.

(i) Coordination involves two separate elements: notification and response.

Both or either may be oral or in written form. To be acceptable for filing, all applications and major technical amendments must certify that coordination, including response, has been completed. The names of the users with coordinated proposals, applicants, permittees, and licensees with which coordination was accomplished must be specified.

(ii) Notification must include relevant technical details of the proposal. At minimum, this should include, as applicable, the following:

Applicant's name.

Transmitting station name.

Transmitting station coordinates.

Frequencies and polarizations to be added or changed.

Transmitting equipment type, its stability, actual output power, emission designator, and type of modulation (loading).

Transmitting antenna type, model, gain, and, if required, a radiation pattern provided or certified by the manufacturer.

Transmitting antenna center line height above ground level and ground elevation above mean sea level.

Receiving station name.

Receiving station coordinates.

Receiving antenna type, model, gain, and, if required, a radiation pattern provided or certified by the manufacturer.

Receiving antenna center line height above ground level and ground elevation above mean sea level.

Forward and reverse path azimuth and distance.

- (iii) For transmitters employing digital modulation techniques, the notification should clearly identify the type of modulation. Upon request, additional details of the operating characteristics of the equipment shall also be furnished.
- (iv) Response to notification should be made as quickly as possible, even if no technical problems are anticipated. Any response to notification indicating potential interference must specify the technical details and must be provided to the applicant, in writing, within the 30-day notification period. Every reasonable effort should be made by all applicants, permittees and licensees to eliminate all problems and conflicts. If no response to notification is received within 30 days, the applicant will be deemed to have made reasonable efforts to coordinate and may file its application without a response.
- (v) The 30-day notification period is calculated from the date of receipt by the applicant, permittee, or licensee being notified. If notification is by mail, this date may be ascertained by:
  - (A) The return receipt on certified mail;
  - (B) The enclosure of a card to be dated and returned by the recipient;  
or
  - (C) A conservative estimate of the time required for the mail to reach its destination.

In the latter case, the estimated date when the 30-day period would expire should be stated in the notification.

- (vi) An expedited prior coordination notification period (less than 30 days) may be requested when deemed necessary by a notifying carrier. The coordination notice should be identified as "expedited" and the requested response date should be clearly indicated. However, circumstances preventing a timely response from the receiving carrier should be accommodated accordingly. It is the responsibility of the notifying carrier to receive written concurrence (or verbal, with written to follow) from affected parties or their coordination representatives.
- (vii) All technical problems that come to light during coordination must be resolved unless a statement is included with the application to the effect that the applicant is unable or unwilling to resolve the conflict and briefly the reason therefor.
- (viii) Where a number of technical changes become necessary for a system during the course of coordination, an attempt should be made to minimize the number of separate notifications for these changes. Where the changes are incorporated into a completely revised notice, the items that were changed from the previous notice should be identified. When changes are not numerous or complex, the carrier receiving the changed notification should make an effort to respond in less than 30 days. When the notifying carrier believes a shorter response time is reasonable and appropriate, it may be helpful for that carrier to so indicate in the notice and perhaps suggest a response date.
- (ix) If, after coordination is successfully completed, it is determined that a subsequent change could have no impact on some carriers receiving the

original notification, these carriers shall be notified of the change and of the coordinator's opinion that no response is required.

- (x) Applicants, permittees and licensees should supply to all other applicants, permittees and licensees within their areas of operations, the name, address and telephone number of their coordination representatives. Upon request from coordinating applicants, permittees and licensees, data and information concerning existing or proposed facilities and future growth plans in the area of interest should be furnished unless such request is unreasonable or would impose a significant burden in compilation.
- (xi) Carriers should keep other carriers with whom they are coordinating advised of changes in plans for facilities previously coordinated. If applications have not been filed 6 months after coordination was initiated, carriers may assume that such frequency use is no longer desired unless a second notification has been received within 10 days of the end of the 6 month period. Renewal notifications are to be sent to all originally notified parties, even if coordination has not been successfully completed with those parties.
- (xii) Any frequency reserved by a licensee for future use in the bands subject to this Part must, upon a showing by another licensee that it requires an additional frequency and cannot coordinate one that is not reserved for future use, file for the frequency within six (6) months after receiving such a showing or release the frequency for use by the requesting licensee.



(b) Where frequency conflicts arise between co-pending applications in the Point-to-Point Microwave Radio and Local Television Transmission Services, it shall be the obligation of the later filing applicant to amend its application to remove the conflict, unless it can make a showing that the conflict cannot be reasonably eliminated. Where a frequency conflict is not resolved and no showing is submitted as to why the conflict cannot be resolved, the Commission may grant the first filed application and dismiss the later filed application(s) after giving the later filing applicant(s) 30 days to respond to the proposed action.

**REASON FOR RULE:**

In the Second Report and Order (paragraphs 59-60), the Commission, to be consistent with current industry practices, decided that, for the 4 GHz through 11 GHz bands, it would use the common carrier Part 21 prior coordination procedure. TIA agrees and thus proposes using the prior coordination procedure, as specified in current Section 21.100, for all point-to-point microwave bands subject to Part 101.

The benefits derived from the prior coordination process were well documented in the record of Docket No. 92-9. Data are transmitted more expeditiously between coordinators, databases are updated quickly, and processing burdens on the Commission are reduced substantially. If the industry polices itself for interference conflicts, as is currently done under Part 21.100, the Commission can devote more resources to processing applications in a timely manner.

For example, in the MAS band, approximately 1,200 applications were filed in 1993. Under the current system, coordination agencies engineer these systems independently, based on data received from the Commission. Applicants then have up to 6 months to file an application. The Commission then reviews each application for potential conflicts and accepts or dismisses the application. Since interference protection in this band is based upon a set

distance criteria and the band is highly congested, competing applications occur frequently. Approximately 34 MAS applications in 1993 were dismissed due to mutual exclusivity with another proposal or interference conflicts with an existing system. Under this situation everyone loses. The applicant loses needed spectrum and potential revenue and the coordinating agency loses respect due to factors out of its control.

With prior coordination, mutually exclusive MAS sites and interference conflicts would be identified in the engineering process, not after several months of application processing time. This process could permit the Commission to expedite license grants.

In addition, TIA proposes certain specific highlighted changes to Section 21.100 so the new Part 101 provisions for frequency coordination would conform to current industry practice:

- Section (a)(1) -- This section contains four (4) necessary proposed changes. First, proposed frequency usage shall be prior coordinated with "other users with previously coordinated proposals" so that such proposals would be protected, thereby eliminating uncertainty over whether prior coordination is required under these circumstances. Second, coordination would be required prior to filing any amendment or modification, regardless of the nature of the change. Third, the rules are clarified to indicate that future system growth, that is to be protected from interference, must be prior coordinated. Fourth, an applicant no longer would be required to provide an explanation with the application if a party, with which it is coordinating, does not timely respond to a notification.
- Section (a)(2)(ii) -- The technical details that must be included in the notification are changed to make the data provided more useful.

- Section (a)(2)(iii) – Given the emergence of digital radios in the higher bands, information regarding type of modulation and equipment operating characteristics no longer would be limited to transmitters operating below 15 GHz.
- Section (a)(2)(iv) – Oftentimes, a response to the prior coordination notice does not contain the reasons for the problem. To assist the applicant in addressing the response, this section should be revised to require the responding party to provide these reasons upon any oral notification and to submit written documentation describing any interference problem during the 30-day notification period.
- Section (a)(2)(vi) – This new section provides for expedited prior coordination notices of less than 30 days.
- Section (a)(2)(ix) – This section would streamline the notification process.
- Section (a)(2)(xii) – This section is revised to accommodate the needs of licensees which have invested in growth channels. To protect this investment, a licensee would have six (6) months to file for the frequency or lose it to another applicant or licensee.

## INTERFERENCE PROTECTION

### PROPOSED RULE:

#### SECTION 101.\_\_\_\_ INTERFERENCE PROTECTION.

Interference protection criteria for fixed stations subject to this Part are specified in the TIA "Telecommunications Systems Bulletin No. 10, Interference Criteria for Microwave Systems," and are incorporated herein by reference.

### REASON FOR RULE:

In the Second Report and Order (paragraph 60), the Commission determined that interference standards for common carrier and private licensees should be harmonized and should be administered by a single recognized standards body, such as TIA TR14.11. TIA's Bulletin 10-F, when adopted, will be the benchmark industry standard for microwave interference protection. As the product of substantial and concerted effort by a broad range of industry participants, including numerous microwave equipment manufacturers and providers, the Bulletin 10-F criteria should be the most accurate, up-to-date set of standards addressing this problem.

Once adopted, Bulletin 10-F will address directly several issues specifically related to protecting microwave users from interference. Not only will Bulletin 10-F reflect revisions to general fixed microwave interference matters, it will include a separate annex addressing PCS-microwave interference based upon: the Commission's new microwave channel plans adopted in the Second Report and Order (ET Docket No. 92-9), 8 FCC Rcd 6495 (1993); separate requirements for short-haul microwave paths; and procedures for prior coordination notice. The rule should reference Bulletin 10 to accommodate future versions.

## TRANSMITTER POWER

### PROPOSED RULE:

#### SECTION 101.\_\_\_\_(a) TRANSMITTER POWER LIMITATIONS.

On any authorized frequency, the average power delivered to an antenna in this service shall be the minimum amount of power necessary to carry out the communications desired. Application of this principle shall include, but not be limited to, requiring a licensee who replaces one or more of its antennas with larger antennas to reduce its antenna input power by an amount appropriate to compensate for the increased primary lobe gain of the replacement antenna(s). In no event shall the average equivalent isotropically radiated power (EIRP), as referenced to an isotropic radiator, exceed the values specified below. In cases of harmful interference, the Commission may, after notice and opportunity for hearing, order a change in the effective radiated power of this station. Further, the output power of a transmitter on any authorized frequency in this service shall not exceed the following:

Frequency Band (MHz)	Maximum allowable transmitter power*		Maximum allowable EIRP (2)*	
	Fixed (W)	Mobile (W)	Fixed (dBW)	Mobile (dBW)
928.0 to 929.0	5.0	....	+17	....
932.0 to 932.5	....	....	+17	....
932.5 to 935.0	20.0	....	+40	....
941.0 to 941.5	....	....	+30	....
941.5 to 944.0	20.0	....	+40	....
952.0 to 960.0	20.0 (1) (2)	....	+40 (3)	....
1,850 to 1,990	20.0	....	+45	....
2,110 to 2,130	20.0	....	+45	....
2,130 to 2,150	20.0	....	+45	....

2,150 to 2,160	20.0 (8)	....	+45 (3)	....
2,160 to 2,180 (8)	20.0	....	+45	....
2,180 to 2,200	20.0	....	+45	....
2,450 to 2,500	20.0	....	+45	....
2,500 to 2,686	10.0 (8)	....	+45 (4)	....
2,686 to 2,690	0.25	....	+45 (4)	....
3,700 to 4,200	20.0	....	+55	....
5,925 to 6,425	20.0	....	+55	....
6,425 to 6,525	....	20.0	....	+35
6,525 to 6,875	20.0	....	+55 (4)	....
10,550 to 10,680	10.0 (6)	....	+55	....
10,700 to 11,700	10.0	....	+55	....
12,200 to 12,700 (5)	10.0	10.0	+50	....
12,700 to 13,250	10.0	10.0	+50 (4)	....
17,700 to 18,600	10.0	....	+55	....
18,600 to 18,800	10.0 (7)	....	+35	....
18,800 to 19,700	10.0	....	+55	....
21,200 to 23,600 (5)	10.0	....	+55	....
27,500 to 29,500	10.0	....	+55	....
31,000 to 31,300	0.05	0.05	....	....
38,600 to 40,000	10.0	1.5	+55	....

\*Per polarization.

- (1) Peak envelope power shall not exceed five times the average power.
- (2) For multiple address operations, see Section [94.65(a)(1)(v)]. When an omnidirectional antenna is authorized in the 2150-2160 MHz band, the maximum power shall be 60 dBm.
- (3) Also, see Section [94.77].
- (4) The output power of a Digital Termination System nodal transmitter shall not exceed 0.5 watts per 250 KHz. The output power of a Digital Termination system user transmitter shall not exceed 0.04 watts per 250 KHz. The transmitter power in terms of the watts specified is the peak

envelope power of the emission measured at the associated antenna input port. The operating power shall not exceed the authorized power by more than 10 percent of the authorized power in watts at any time.

(5) Maximum power delivered to antenna shall not exceed -3 dBW.

(6) Remote alarm units that are part of a multiple address central station protection system are authorized a maximum of 2 watts.

(7) Also, see Sections [94.90 and 94.91].

(8) In the 2150-2162 MHz, 2596-2644 MHz, 2650-2656 MHz, 2662-2668 MHz and 2674-2680 MHz frequency bands, when used for the Multipoint Distribution Service, EIRP up to 2000 watts may be authorized pursuant to [§21.904] of this part.

#### SECTION 101.\_\_\_\_(b) ATPC.

The power of transmitters that use Automatic Transmitter Power Control shall not exceed the power input or output specified in the instrument of station authorization. The power of non-ATPC transmitters shall be maintained as near as practicable to the power input or output specified in the instrument of station authorization.

#### REASON FOR RULE:

Transmitter Power Limitations – TIA proposes adopting the Section 94.73 provisions for transmitter power limitations because these rules are more comprehensive than the Section 21.107 rules. However, TIA also proposes including the Section 21.107 language regarding resolution of harmful interference.

In the table of maximum allowable transmitter power and Equivalent Isotropic Radiated Power (EIRP), with limited exception, TIA proposes a maximum EIRP of +55 dBW for all point-to-point microwave bands from 4 GHz to 40 GHz. In the Second Report and Order, the current EIRP standards from Section 21.107 and Section 94.73 are retained in each band. However, these standards are inconsistent. The EIRP standard for the 5,925-6,425 MHz and 17,700-19,700 MHz bands is +55 dBW. The EIRP standard for the 6,525-6,875 MHz, 10,550-10,680 MHz, and

10,700-11,700 MHz bands is +50 dBW. The EIRP standard for the 23 and 38 GHz bands is +50 dBW in Part 21 and +40 dBW in Part 94.

TIA recommends that a common EIRP standard of +55 dBW be applied to point-to-point bands above 4 GHz. The transmit power of state-of-the-art digital microwave radios is typically 1 to 5 watts for the 4, 6, 10, and 11 GHz bands. In the 4 and 6 GHz bands, antennas ranging from 6 to 15 feet in diameter are available. In the 10 and 11 GHz bands, antennas from 2 to 12 feet are available. The following table shows typical EIRPs, assuming a 5 watt transmit power and 100 feet of waveguide in each band:

Frequency Band (GHz)	Transmit Power (dbM)	Antenna Size (feet)	Antenna Gain (dBi)	Waveguide Loss (dB)	Calculated EIRP (dBW)
4.0	+37	15	42.7	0.8	48.9
6.1	+37	15	46.4	1.2	52.2
6.7	+37	15	47.1	1.4	52.7
10.5	+37	12	49.3	3.2	53.2
11.2	+37	12	49.8	3.1	53.7

As shown in the table, the +50 dBW EIRP standard cannot be achieved in most frequency bands without reducing antenna sizes. As a result, the +50 dBW EIRP standard will impact adversely the path reliability on long paths, where large antennas are required.

In addition, microwave users will prefer the lower 6 GHz band over the upper 6 GHz band, since higher power is allowed in the lower 6 GHz band. This will contribute to unbalanced use of the frequency bands. Setting a common +55 dBW EIRP standard will prevent these problems.

The EIRP standard is also a concern at 18, 23, and 38 GHz, due to the higher susceptibility of these frequency bands to rain outage and atmospheric absorption loss. The current EIRP standard is +55 dBW for the 18 GHz band. The standard is lower for the 23 and



38 GHz bands. TIA proposes that the same EIRP standard should be set for 18, 23, and 38 GHz bands to allow higher power and to improve path reliability. However, no changes in EIRP standards are proposed for the 12.2-13.25 GHz and 18.6-18.8 GHz bands.

The use of a +55 dBw EIRP standard is not unprecedented. For example, this same standard also is used in Part 25 of the Commission's Rules for determining terrestrial station frequency coordination distances in the 4, 6 and 11 GHz bands. In addition, this EIRP standard is in Title II, Appendix 28 of the ITU Rules and Regulations.

ATPC – This rule is necessary to ensure that licensees using ATPC and licensees without ATPC operate at a permissible power level. A licensee using ATPC has the flexibility to deviate downward from its licensed power level. However, it must be made clear that licensees not using ATPC must operate as near as practicable to their authorized power level.

## DIGITAL AND ANALOG MODULATION

### PROPOSED RULE:

#### SECTION 101.\_\_\_\_ (a) DIGITAL MODULATION.

(1) Existing systems are grandfathered and are allowed to grow or be modified in accordance with the rules that were in force at the time of their licensing.

(2) For the purpose of compliance with the emission limitation requirements of [Section 21.106(a)(2)] of this Part and the requirements of paragraph (a)(3) of this section, digital modulation techniques are considered as being employed when:

(i) digital modulation occupies 50% or more of the necessary bandwidth of a transmitter. This definition shall apply to all transmitters, except those employing frequency modulation; or

(ii) digital modulation contributes 50% or more to the total peak frequency deviation of a transmitter radio frequency carrier, in a transmitter employing frequency modulation. The total peak frequency deviation shall be determined by adding the deviation produced by the digital modulation signal and the deviation produced by any frequency division multiplex (FDM) modulation used.

(3) Microwave transmitters employing digital modulation techniques and operating ~~below 24 GHz~~ shall, with appropriate multiplex equipment, comply with the following additional requirements:

(i) The bit rate, in bits per second, shall be equal to or greater than the bandwidth specified by the emission designator in Hertz (e.g., to be acceptable, equipment transmitting at a 20 Mb/s rate must not require a bandwidth of greater than 20 MHz), except the bandwidth used to calculate the minimum rate shall not include any authorized guard band.

(ii) Equipment to be used for voice transmission placed in service, authorized, or applied for on or before June 1, 1997, in the 2110 to 2130 and 2160 to 2180 MHz bands shall be capable of satisfactory operation within the authorized bandwidth to encode at least 96 voice channels. Equipment placed in service, authorized, or applied for on or before June 1, 1997, in the 3700-4200, 5925-6425 (30 MHz bandwidth), and 10,700-11,700 MHz (30 and 40 MHz bandwidths) bands shall be capable of satisfactory operation within the authorized bandwidth to encode at least 1152 voice channels. These required loading levels may be reduced by a factor of  $1/N$  provided that  $N$  transmitters may be operated satisfactorily, over the same radio path, within an authorized bandwidth less than, or equal to, the maximum authorizable bandwidth (e.g., the 1152 channel requirement may be reduced to 576 if two transmitters can be satisfactorily operated over the same path within the maximum bandwidth). Where type accepted equipment is designed to operate on the same frequency in a cross polarized configuration to meet the above capacity requirements, the Commission will require, at the time additional transmitters are authorized, that both polarizations of a frequency be used before a new frequency assignment is made, unless a single transmitter installation was found to be justified by the Commission at the time it authorized the first transmitter.

(iii) The following capacity and loading requirements shall be met for equipment applied for, authorized, and placed in service after June 1, 1997, in the 3700-4200 MHz (4 GHz), 5925-6425 and 6525-6875 MHz (6 GHz), 10,550-10,680 MHz (10 GHz), and 10,700-11,700 MHz (11 GHz) bands:

Nominal Channel Bandwidth (MHz)	Minimum Payload Capacity (Mbits/s)*	Minimum Traffic Loading Payload (as % of payload capacity)	Typical Utilization**
0.400	1.54	n/a	1 DS-1
0.800	3.08	n/a	2 DS-1
1.250	3.08	n/a	2 DS-1
1.600	6.17	n/a	4 DS-1
2.500	6.17	n/a	4 DS-1
3.750	12.30	n/a	8 DS-1
5.000	18.50	n/a	12 DS-1
10.000	44.70	50***	1 DS-3/STS-1
20.000	89.40	50***	2 DS-3/STS-1
30.000 (11 GHz)	89.40	50***	2 DS-3/STS-1
30.000 (6 GHz)	134.10	50***	3 DS-3/STS-1
40.000	134.1	50***	3 DS-3/STS-1

\*Per polarization.

\*\*DS and STS refer to the number of voice circuits a channel can accommodate. 1 DS-1 = 24 voice circuits; 2 DS-1 = 48; 4 DS-1 = 96; 8 DS-1 = 192; 12 DS-1 = 288; 1 DS-3/STS-1 = 672; 2 DS-3/STS-1 = 1344; 3 DS-3/STS-1 = 2016.

\*\*\*This loading requirement must be met within 30 months of licensing. If two transmitters simultaneously operate on the same frequency over the same path, the requirement is reduced to 25 percent.

(iv) If a transmitter is authorized to operate in a bandwidth that is not listed in paragraph (a)(3)(iii) of this section, it shall meet the minimum payload capacity and traffic loading requirements of the next largest channel bandwidth listed in the table; e.g., if the authorized bandwidth is 3.5 MHz, the minimum payload capacity shall be 12.3 Mbits/s.

(v) Transmitters carrying full motion digital video material are exempt from the requirements specified in Paragraphs (a)(3)(ii) and (a)(3)(iii) of this section provided that the minimum bit rate specified in Paragraph (a)(3)(i) is met and at least 50% of the base band capacity is used for full motion digital video. In the 6, 10, and 11 GHz bands, concatenation of multiple contiguous channels is permitted for channels of equal bandwidth on center frequencies, provided no other channels are available and the minimum payload capacity requirements are met.

(vi) Digital systems using bandwidths of 10 MHz or larger will be considered 50% loaded when the following condition is met: at least 50% of their total DS-1 capacity is being used. A DS-1 channel is being used when it has been connected to a DS-0/DS-1 multiplexer. For non-DS-0 services, such as, but not limited to, video or broadband data transmission, the next largest DS-1 equivalent will be considered for the computation of a loading percentage.

(vii) For digital systems, minimum payload capacities shall be expressed in numbers of DS-1s, DS-3s or STS-1s. The payload capacity required by the Commission shall correspond to commercially available equipment.

NOTE: Systems authorized in the 17,700-19,700 MHz and 21,200 - 23,600 MHz bands prior to December 1, 1988, may install equipment with no minimum bit rate.

**REASON FOR RULE:**

Proposed Section 101.\_\_\_\_(a) for digital modulation merges current Sections 21.122 and 94.94 to be consistent with the Second Report and Order and to accommodate all digital bit rates in current frequency plans. This revision defines digital modulation in terms of bandwidth utilization (i.e., digital modulation occupies 50% or more of the necessary bandwidth), while retaining the current definition separately for systems employing frequency modulation.

All digital equipment operating below 24 GHz meet the Commission's specified bit rate in current Section 21.122. Thus, TIA proposes changing the scope of equipment subject to this bit rate requirement from below 15 to below 24 GHz. This change eliminates the need for current Section 21.122(e) and thus it has been deleted.

TIA also proposes adopting a separate rule section for analog systems (i.e., Section 101.\_\_\_\_(b)). The technical requirements and spectrum efficiency ratings for digital and for analog are quite different (e.g., some analog systems could need more bandwidth than comparable digital systems).

Digital systems are better expressed in terms of DS-1, DS-3 and STS-1:

The primary mission of transport networks used to be the carriage of voice channel information. It is no longer true today. Typical digital applications, like LANs, video, high-speed data transfer and imaging often will use more than one DS-0 and are better expressed in terms of Mbit/s or DS-1s. Furthermore, the possibility of using 32 ADPCM or 16 ADPCM systems make any voice loading requirements irrelevant to digital networks.

As SONET becomes the new national (and international with SDH) digital hierarchy, all digital network applications will be expressed in number of DS-1s (in periphery of the SONET network) or in number of STS-1s (inside the network), not in terms of DS-0s.

The number of DS-0s cannot be used as a basis for rules since  $N \times \text{DS-0}$  does not correspond to any officially recognized interface. Except for very low capacity systems (typically available in one-twelve voice channel capacity), commercially available microwave transmission equipment only will operate and transmit at  $N \times \text{DS-1}$ ,  $N \times \text{DS-3}$ , or  $N \times \text{STS-1}$  levels. For low, medium and high capacity systems (greater than or equal to 1 DS-1 or 24 voice channels), the necessary bandwidth calculations should be based on these recognized interfaces.

TIA also proposes that the payload capacity correspond to commercially available equipment. This proposal is made to avoid past problems resulting from users being required by the Commission to license equipment with a capacity that is unavailable in the marketplace.

Loading of a given DS-1 may vary significantly from one end of the system to another:

Several applications of microwave radios have significant Drop/Insert requirements. Using a conventional digital multiplexer, a single DS-1 will be needed to drop and insert even a few channels in a particular site. DACCs can reduce the total number of DS-1s used in a given system. However, DACCs or Drop/Insert channel banks are not common in smaller size systems and when they are present in larger ones, they are not always found in all branches. In a typical microwave system used, for example, by a utility company, each DS-1 being used is probably loaded at an average level of approximately 60%. Consequently, it will be common, in a properly designed system, to find DS-1s that are loaded from between 30% to 100%.

Full motion digital video

Any exception to the loading or efficiency rules must not become an opportunity to circumvent them. The proposed revision obtains more efficient channelization of frequencies used primarily for satellite entrance links, by requiring that video constitute at least 50% of the digital radio payload.

Loading requirements in summary:

SYSTEM TYPE	CRITERIA
Digital, <10 MHz BW	No loading criteria
Digital, ≥10 MHz BW	To meet Docket 92-9 objectives, 50% of the system total DS-1 capacity must be used.
Transmitters carrying full motion digital video material	No loading requirement if the following criteria are met: <ul style="list-style-type: none"><li>- The minimum bit rate specified in (a)(1) of [§21.122] in Docket 92-9 is met; and</li><li>- At least 50% of the baseband capacity is used for full motion digital video.</li></ul>



**PROPOSED RULE:**

## Section 101.\_\_\_\_ (b) ANALOG MODULATION.

Except for video transmission, an application for an initial working channel for a given route will not be accepted for filing where the anticipated loading (within five years for voice, or other period subject to reasonable projection) is less than the minimum specified for the following frequency bands. Absent extraordinary circumstances, applications proposing additional frequencies over existing routes will not be granted unless it is shown that the traffic load will shortly exhaust the capacity of the existing equipment. Where no construction of radio facilities is requested, licensees must submit this evidence with their filing of any necessary authority required pursuant to section 214 of the Communications Act and Part 63 of this chapter.

Frequency Band (MHz)	Minimum Number of Voice Channels (4 KHz or equivalent)
3700 to 4200 (20 MHz bandwidth)	900
5925 to 6425 (10 MHz bandwidth)	300
5925 to 6425 (20 MHz bandwidth)	600
5925 to 6425 (30 MHz bandwidth)	900
6525 to 6875 (10 MHz bandwidth)	300
10,700 to 11,700 (10 MHz bandwidth)	300
10,700 to 11,700 (20 MHz bandwidth)	600
10,700 to 11,700 (30 MHz bandwidth)	900
10,700 to 11,700 (40 MHz bandwidth)	900

**REASON FOR RULE:**

With regard to analog systems, the minimum number of voice channels should be specified for systems operating in a bandwidth of 10 MHz or larger. The anticipated loading